10 Hz Triplet Vibrations

- Why does it matter?
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Why does it matter?

Horizontal beam jitter at $\approx 10\,\mathrm{Hz}$ is observed at all BPMs around the RHIC rings

RMS amplitude: $5 - 10\%$ of horizontal rms beam size

Caused by mechanical vibration of RHIC triplets

May cause emittance blow-up due to modulated offset at IPs

Relative beam offset at IPs will increase for RHIC-II due to smaller emittances and smaller β^* (= larger β in triplets)

Measurements with beam

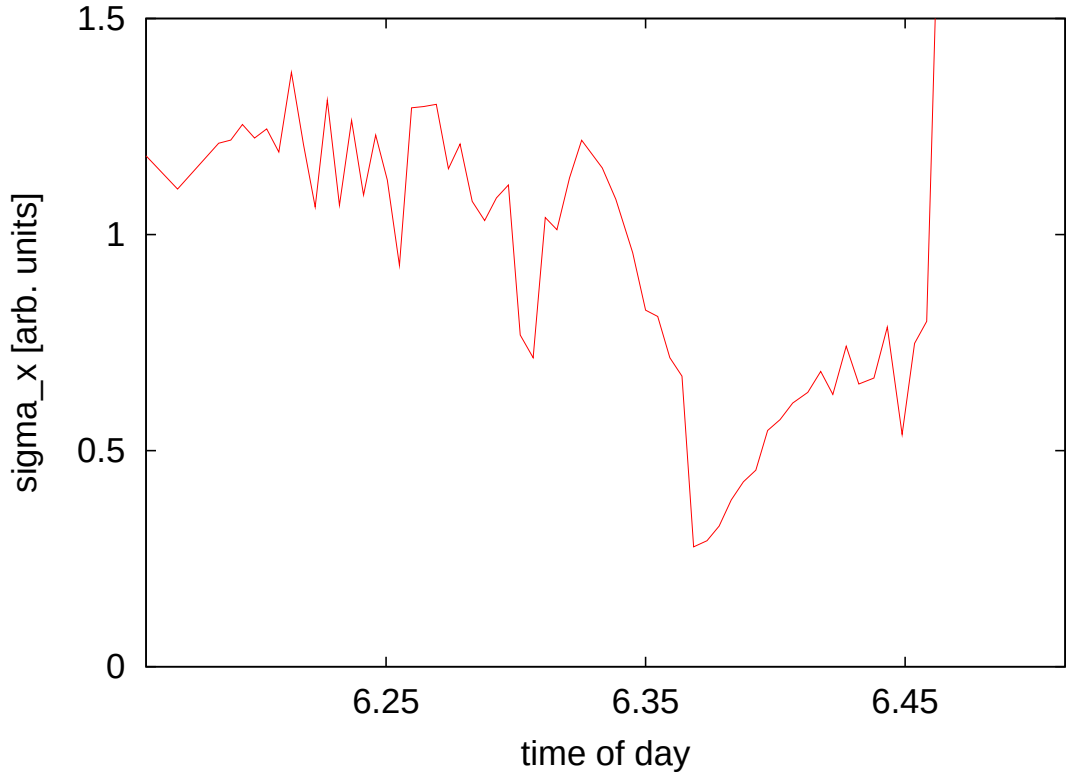
Observed beam jitter frequencies are eigenmodes of the triplets

What is driving them?

#1 candidate: Helium flow

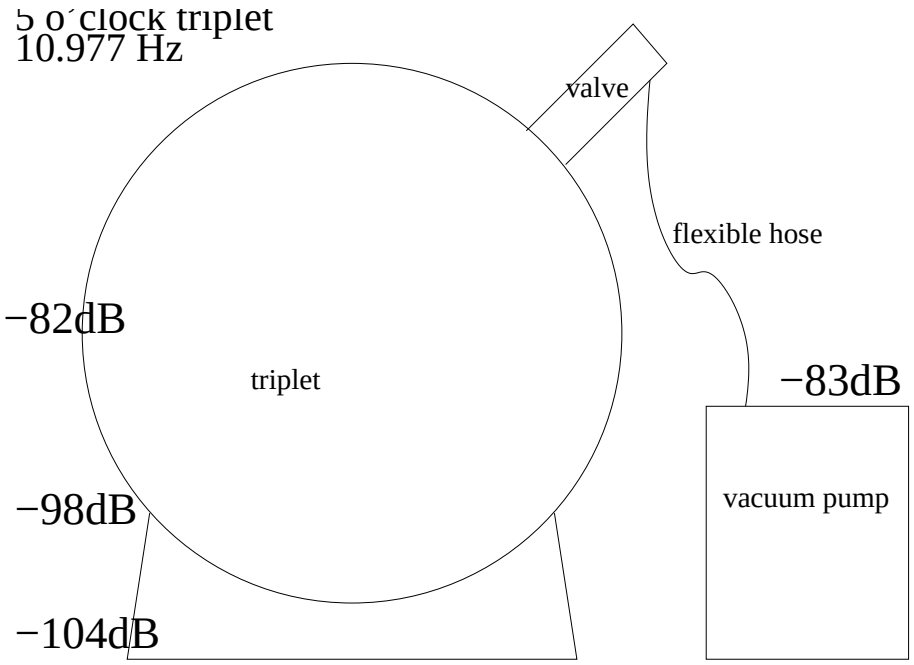
Experiment: Reduce helium flow to 10 percent, observe beam jitter

Horizontal rms beam jitter amplitude, 8.5 – 14.5 Hz

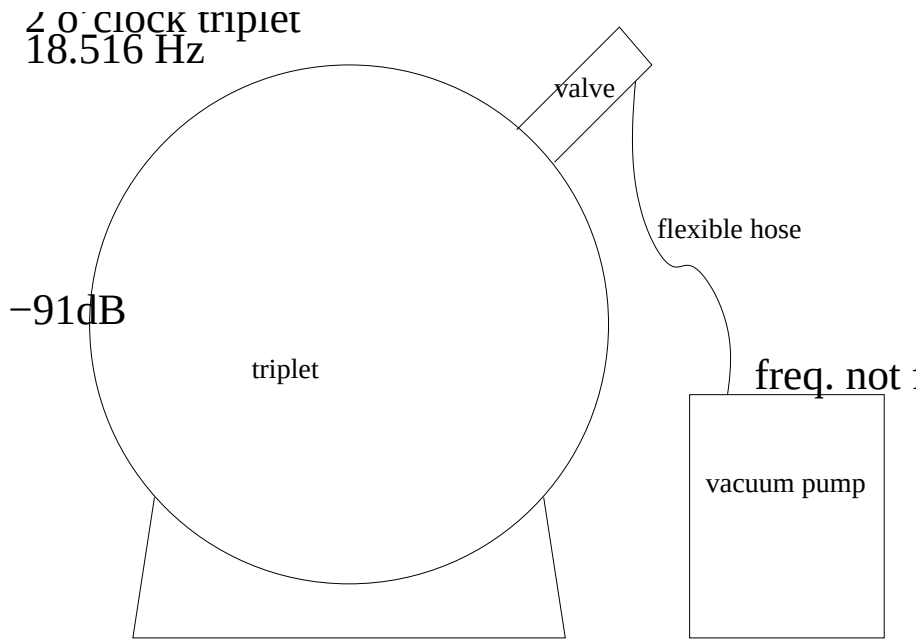


Helium flow was reduced from 6:15 (start of experiment) to 6:45

Measurements in the tunnel



$f = 10.977\,\mathrm{Hz}$ clearly present in beam jitter spectrum



$f = 18.516\,\mathrm{Hz}$ cannot be detected in beam jitter spectrum

Triplet modifications

At typical amplitudes of 100 nanometers, there is no chance to introduce a damping term via friction

However, vibration amplitudes tend to get smaller at higher frequencies

Plan: Increase eigenmode frequencies by stiffening the triplets (cold masses against cryostat/floor)

$\rightarrow$ Gary's talk